IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF WISCONSIN
GREEN BAY DIVISION

UNITED STATES OF AMERICA and THE STATE OF WISCONSIN, Plaintiffs, v. NCR CORPORATION, *et al.*, Defendants.	Hon. William C. Griesbach Civil Action No. 10-C-910 DECLARATION OF XIAOCHUN ZHANG

I, Xiaochun Zhang, hereby declare under penalty of perjury that the following is true and correct:

1. I have a Ph.D. in Civil Engineering with an emphasis on Water Resources from the University of Wisconsin-Milwaukee, a master's degree in Environmental Science and Engineering from Virginia Polytechnic Institute and State University, also known as Virginia Tech, and a bachelor's degree in Environmental Science and Engineering from Zhejiang University, in Hangzhou, China.

2. I am a Water Resources Engineer at the Wisconsin Department of Natural Resources (WDNR). I have held this position since July 1992.

3. My responsibilities as a Water Resources Engineer for WDNR include work related to collecting contaminated sediment samples, analyzing data, assessing extent of environmental contamination and potential sources, modeling the fate and transport of contaminated sediments, reviewing engineering design for remediation of contaminated sediment sites, and managing contaminated sediment site cleanup project.

4. I was assigned to the Fox River contaminated sediment management project ("the Lower Fox River Site") between 1993 and 1998. My original role in the Fox River matter was to assist in WDNR's effort to use water quality models to evaluate PCB fate and transport in the Lower Fox River. I worked with earlier versions of the models employed by WDNR and EPA, particularly the Upper Fox (UF) River model. I also had some involvement in the cooperative

efforts of WDNR and the Fox River Group to develop computational models to assist WDNR and EPA in selection of environmental remedies for the Lower Fox River Site. (The Fox River Group is a group of companies potentially responsible under CERCLA for the cleanup of contamination in the Lower Fox River.) More recently, I have provided assistance to the project on an as-needed basis.

5. This Declaration discusses the Whole Lower Fox River Model (the "wLFRM"), which is one of the models used by WDNR and EPA to help select environmental remedial actions at the Lower Fox River Site.

6. The term "Whole Lower Fox River" refers to the entire 39 miles of the Lower Fox River from the outlets of Lake Winnebago to the river mouth. In the model development history, the river reach between the outlets of Lake Winnebago and De Pere was referred to as the Upper Fox (UF) River while the last 7 miles of the river, or downstream of De Pere, was referred to as the Lower Fox (LF) River.

7. This Declaration is based on my personal knowledge.

WDNR's and EPA's Use of Models at the Lower Fox River Site

8. WDNR employed computer models to assist in its investigation of PCB contamination in the Lower Fox River, and to evaluate PCB cleanup levels at the Lower Fox River Site. The cleanup levels were stated in terms of concentrations of PCBs in river sediment at specified locations.

9. Using inputs that reflected characteristics of the river and the watershed in various locations of the Lower Fox River under site-specific hydrological and hydraulic conditions, the wLFRM model predicted, for varying levels of post-cleanup PCB concentrations in river sediment in specific locations, where and in what concentrations PCBs in river would come to be over a 100-year time period. The model also predicted PCB concentrations without remedial action. This alternative was called the "no action" or "natural recovery" alternative.

10. Using results from the wLFRM to run other models, such as the Fox River Food Web (FRFood) Model, WDNR assessed how quickly and to what extent reductions in PCB concentrations in river sediment would reduce PCB concentrations in fish and other biota in the food chain.

11. Thus, WDNR and EPA used the wLFRM, along with other models and other scientific data and information, to evaluate how quickly and to what extent different proposed PCB cleanup levels in the Lower Fox River and Green Bay would reduce PCB concentrations in sediment and in the water column, and how quickly and to what extent those PCB reductions would reduce the bio-accumulation of PCBs in fish and other biota in the food chain.

12. These calculations helped WDNR and EPA select PCB cleanup levels for river

sediment in specific locations that would reduce PCB bio-accumulation in food chain biota, thereby ensuring that the cleanup would protect human health and the environment.

13. As described in the model documentations, WDNR and EPA used the model results to compare remediation scenarios in a relative sense, after the models were developed and calibrated. This was an appropriate use of the models, given the inherent uncertainties in the application of any computational models.

The Development of wLFRM

14. The wLFRM is a product of more than ten years of field studies and four generations of model development and performance assessment efforts. See White Paper No. 16, wLFRM Development and Calibration for the Lower Fox River/Green Bay Remedial Investigation, Feasibility Study, Proposed Remedial Action Plan, and Record of Decision (December 2002). The wLFRM was developed with the collaborative efforts of the Fox River Group and a group of independent consultants.

Calibration of the Model

15. As a critical part of the water quality model development, WDNR calibrated the wLFRM before running the long term predictions.

16. To calibrate the model, WDNR further developed the IPX computer program and the model inputs that fed to the IPX program to simulate the PCB transport for the years 1989 to 1995, for which WDNR had field data about PCB concentrations in river sediment and in the water column at various locations on the Lower Fox River.

17. In this way, WNDR could compare the model's predictions about PCBs in the river with actual data for identified locations in the Lower Fox River and in Green Bay, to see how closely the model's time-specific and location-specific predictions of PCB concentrations in the Fox River matched actual PCB data for specified locations and time.

18. Using this approach, based on the understanding of the Lower Fox River system and the properties of sediment and PCBs, WDNR re-ran and re-calibrated the model by modifying some of the model input parameters until its predictions matched the actual data to a degree of confidence.

19. After the calibration process was complete, the coefficients, mathematical functions, and other factors used for model calibration runs were applied to prediction runs without alteration. These calibration parameters were either built in the pre-processor codes, or directly integrated into the input files. Also finalized was the IPX computer program (IPX274). This ensured that the properly-calibrated version of the wLFRM model was used to make long-term predictions regarding PCB fate and transport in the river system under various clean-up scenarios.

20. The calibration process was carried out in accordance with the metrics and procedures agreed upon by the Fox River Group and WDNR, and documented in various technical memoranda in the administrative record. The calibration variables are described in the report, "Development and Application of a Transport Model for the Lower Fox River," which is included in the administrative record.

21. The administrative record contains extensive documentation describing the development, calibration, and use of the models.

22. For example, the record contains the Model Documentation Report, which describes the development and calibration of the wLFRM. The appendices to the Model Documentation Report contain numerous technical memoranda that further explain the basis of the development, calibration, and application of various components of the wLFRM. These appendices include the report, "Development and Application of a Transport Model for the Lower Fox River" and "IPX User's Manual," which also describes in detail the development of the wLFRM.

23. The administrative record contains EPA's and WDNR's extensive responses to public comments on the development, calibration, and application of the model.

24. Thus, the contents of the administrative record provide a detailed and comprehensive conceptual and technical description of the development and application of the wLFRM.

25. The extensive documentation in the administrative record shows that WDNR carefully considered the river hydrology and hydraulics, sediment properties, sediment loading, properties of PCBs, and the geometry of the Fox River during the model calibration phase. Thus, the calibration process assured that the wLFRM would reliably predict PCB fate and transport in the Fox River system.

Description of the Model and its Various Components

26. The core components of the Whole Lower Fox River Model or "wLFRM" are a computer program, known as IPX Version 2.7.4, the input files for the program, and the data generated by the program and converted into output table files. The wLFRM output table files were used as input for other models, such as the Fox River Food Web Model.

27. The input files for the IPX program were generated by combining the results primarily from a number of separate computational tools or computer programs, called "pre-processors".

28. The pre-processors were used to produce time series of such variables as river flow, rates of suspended particle settling and re-suspension, and sediment loading from point and nonpoint sources in the watershed in forms IPX computer program requires. Based on the

parameters entered into them, the pre-processors generated individual data files. These data files were then combined into a single input file used for model runs.

29. For example, one of the pre-processors developed for the wLFRM was called "SETTLE." Later the name of this program was changed and replaced by a modified program, called "PROBDEP3_LFRM" after WDNR considered comments and suggestions during the wLFRM model development phase. PROBDEP3_LFM was used in place of SETTLE for the final model runs.

30. The pre-processors SETTLE and PROBDEP3_LFRM used data about hydrological and hydraulic conditions and characteristics of solid in the river and from the watershed, along with various parameters, to generate time series of the rate at which suspended particles would settle out of the water column onto river bottom. These settling rates were stored in a file in the format IPX 274 requires. That information was then combined with information generated by the other pre-processors to create an input file for a given model run.

31. When that input file was run through the IPX computer program, it generated data files that contain the concentrations of PCBs in river water column and sediments at specific locations at specific time.

32. In this way, the wLFRM could predict the future effect of reduced PCB levels in river sediments at a particular time on the future concentrations of PCBs in the river and PCB mass transport from the Lower Fox River to Green Bay.

33. Each time WDNR ran the model using a particulate set of input file, the IPX program produced a large amount of output data. The files with extensions of ".dmp" and ".dma" are the key output files for evaluating PCB concentrations in the river system. A post-processor called W4dis274 was then used to extract representative data into text files with a ".tbl" extension. I will refer to these files as the "table" files.

34. The data in the table files were then processed using a post-processor called "Exposure.f" into files with an ".rr" extension. These "rr" files were used as the input for the other models for the model prediction runs.

35. Each model run generated additional output files with the extensions ".exp", ".msb" and ".out." These output files were not essential to the development of input files for the other models for the model prediction runs.

36. As a summary, Diagram 1, as shown below, illustrates the various model components, including the pre-processors, the input files, the output data files, the table files, and the ".rr" files according to the model processing sequence. Note that the shaded components in the diagram are included within the administrative record.

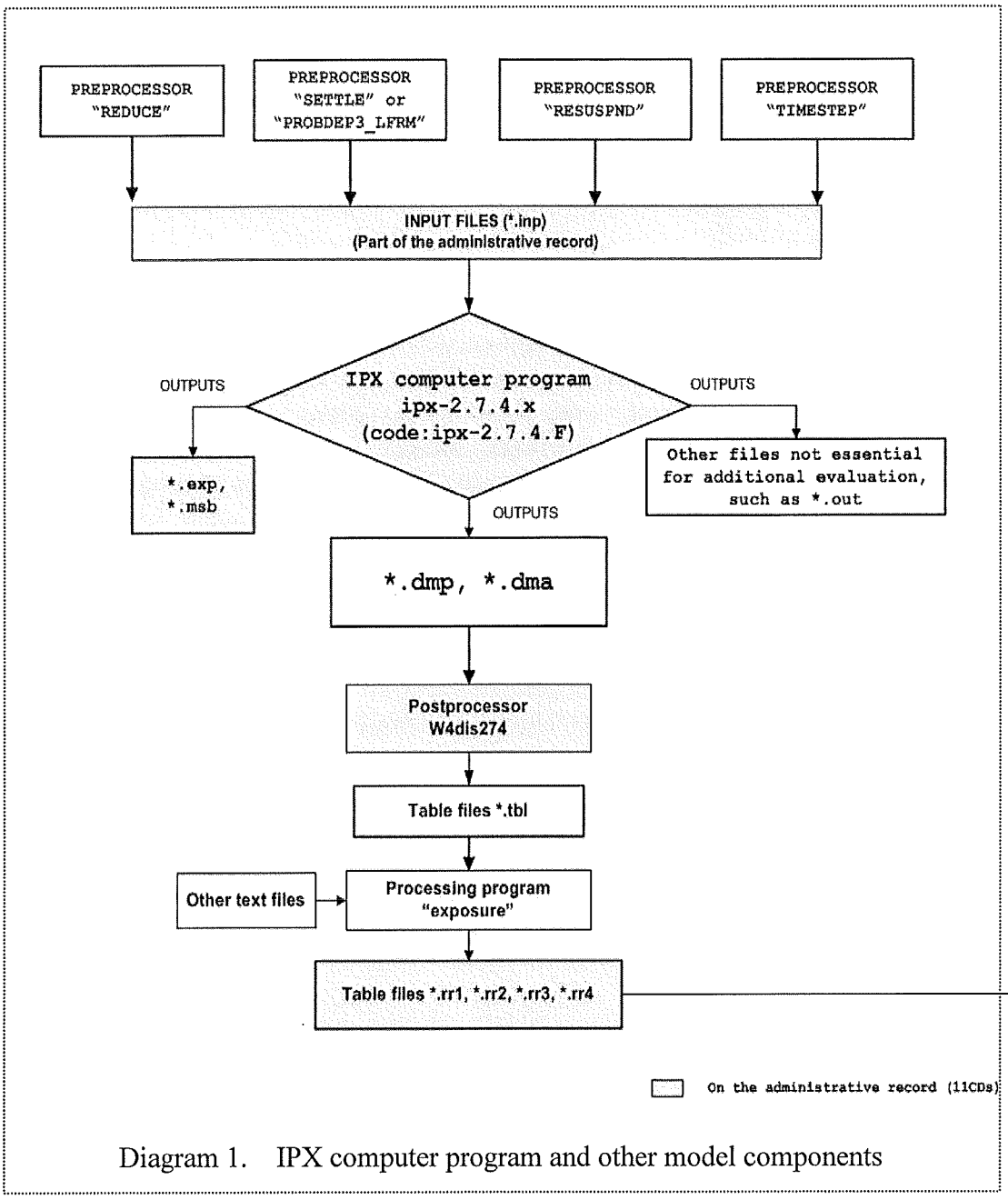

Diagram 1. IPX computer program and other model components

37. As illustrated in Diagram 1, the administrative record contains the input files that were created by combining the files generated by the pre-processors and used for the model runs that formed the basis of EPA's and WDNR's selection of PCB cleanup levels for the Lower Fox River Site.

38. The administrative record also contains the IPX computer program that processed the input files to produce the *.dmp and *.dma output data files, as a result of model prediction runs.

39. The administrative record also contains the ".rr" data files generated by the IPX computer program and the post-processors. These output files were used as the input files for the other models.

40. Thus, using the information contained in the administrative record, it would be possible to run the model for prediction of PCB concentrations in the Lower Fox River that formed the basis for WDNR's and EPA's selection of PCB cleanup levels for the Site, and to thereby re-produce the model output data files *.dmp and *.dma generated by those model runs, if one had a computer capable of running the IPX 2.7.4 program.

41. Because the post-processor W4dis274 is also part of the administrative record, it would be possible to process those output data files to reproduce the "table" files generated by the model runs that formed the basis for WDNR's and EPA's selection of PCB cleanup levels for the Site.

42. Although the administrative record does not contain a copy of the post-processor named "Exposure.f" that processed the "table" files into the ".rr" files used as inputs for the other models, a copy of that post-processor was delivered to Defendants on June 1, 2012, after it was recently provided to WDNR by its former employee Mark Velleux. In addition, after reading Dr. Annear's declaration, I recognized that post processor "W4dis274" he evaluated was not able to produce *.rr files and then I realized that "Exposure.f" was used as a post-processor for the final wLFRM runs. I subsequently located a copy of the file on the backup copy of the UNIX computer files maintained by WDNR.

43. Thus, because the Defendants have a copy of the input files for the final model runs, a copy of the IPX computer program code, and a copy of both post-processors, it is possible for them to run the model using the inputs from the model runs that formed the basis of EPA's and WDNR's selection of PCB cleanup levels for the Site, assuming they use a computer capable of running the IPX 2.7.4 program. Based on those model runs, they can also use the post-processors to reproduce the table files and subsequently the *.rr files from the model runs that were used as input files for the other models.

44. Thus, depending upon the purpose of the ongoing re-evaluation of the wLFRM, it is not true, as Dr. Robert Annear, Jr., claims, that the wLFRM is incomplete. See Annear Dec., Par. 20. Nor is it true, as the Certain Defendants claim, that WDNR and EPA cannot produce full and complete working copies of the wLFRM computer model used to create inputs for the other models.

45. In his Declaration, Dr. Annear claims that the pre-processor SETTLE "still has not been provided" to the Defendants by WDNR. He also refers to the pre-processor PROBDEP3_LFRM." See Annear Dec., Par. 15. As explained above, PROBDEP3_LFRM was developed by WDNR to replace SETTLE, and was used in place of SETTLE to develop the inputs for the final model runs that helped EPA and WDNR selected PCB cleanup levels for the

Site. A copy of PROBDEP3_LFRM was provided to the Certain Defendants in September of 2011.

46. Thus, all of the pre-processors used by WDNR to develop the input files for the final model runs have been provided to the Defendants, and they have all of the post-processors used to process the output data from the wLFRM model runs into the input files used by the other models.

Review of Dr. Annear's and Mr. Susilo's Claims that the Model is Incomplete

47. In his Declaration, Dr. Annear claims that the modeling tools used by WDNR at the Fox River Site included a "processing code" to process the model inputs derived by the various pre-processors into a single input file for use by the IPX program. See Annear Dec., Par. 17.

48. This statement is incorrect. The modeling tools employed by WDNR did not use such a processing code. Rather, the model inputs that were generated by the various pre-processors in the formats required by the IPX computer program were manually combined using WDNR's UNIX computer into a single input file that was used for the wLFRM simulations.

49. Mr. Susilo claims that the relevant output data from the model runs is missing, and that therefore the model results cannot be replicated. The files he is referring to are the ".dmp" and ".dma" and ".out" files. See Susilo Dec., Par. 32(b), footnote 1.

50. As illustrated in Diagram 1, the ".dmp" and ".dma" files represent the large amount of data generated by the model runs that were subsequently processed into the table files, and then processed into the ".rr" files used as the input files for other models.

51. First, the ".dma" and ".dmp" IPX computer output files are voluminous. Secondly, because the administrative record contains the table files, it is not necessary to reproduce this voluminous output data from the final model runs in order to evaluate the wLFRM output files as input for the other models.

52. However, as I explained above, the ".dmp" and ".dma" output data can be reproduced from the input files and the IPX computer program in the administrative record, assuming one has access to a computer capable of running the IPX 2.7.4 program. As I also explained above, the post-processors in the administrative record and in the Defendants' possession would allow the Defendants to process those output files into the ".rr" files generated in the final model runs and used as the input files for the other models.

53. More importantly, as I also explained above, the administrative record contains the ".rr" files generated in the final model runs and used as the inputs for the other models.

54. Mr. Susilo also claims that the ".out" files are missing. However, the ".out" files were not relevant to development of the output files used as input files for other models.

55. Similarly, Dr. Annear refers to "optional IPX message files for the WDNR remedial scenarios." See Annear Dec., Par. 22(h). These files would have consisted of IPX development information and possible error messages, if any were generated, after IPX program taking in the input file during a model run, and other messages that might have been produced from the model runs. These message files did not contain any data or information relied upon to generate results from any of the model runs. They were, instead, files that delivered messages to the computer user about the model run.

56. Dr. Annear states that the model files provided to him do not include the "calibrated wLFRM and all associated input files, outputs and necessary codes (pre-processors, post-processors and models) to replicate the calibrated model runs from 1989 to 1995." See Annear Dec., Par. 17(d).

57. In fact, these files were provided to the Defendants during the model evaluation phase of the modeling effort.

58. In addition, it is not necessary to have a copy of the model calibration runs to evaluate the output files from WDNR's and EPA's 100-year model prediction runs that were used for the other models and formed the basis of EPA's and WDNR's selection of PCB cleanup levels for the Lower Fox River Site.

59. First, WDNR and EPA would have used the same pre- and post-processors developed in the calibration phase for the long-term simulation model runs. The only difference between the calibration runs and the long term prediction runs would have been in the variables reflecting river flow and initial total suspended solids and PCB concentrations. Instead of using the flow data obtained between 1989 and 1995 for the calibration runs, a 25-year flow record for the years 1963 to 1988 was used to configure the model input. Thus, it is sufficient, for purposes of evaluating WDNR's and EPA's application of the model, to have the version of the model and its various components used for the final, long-term simulation model runs, as those versions would have been the same versions used in the final calibration run.

60. Secondly, the model results generated from the calibration runs were used to calibrate the model. Those model runs were not used to evaluate cleanup alternatives.

61. Lastly, the extensive model documentation in the administrative record described the model calibration processes.

62. Thus, it is not true, as Dr. Annear claims, that the absence of the model processing tools and output files to which he refers makes the wLFRM "unreliable and unsuitable as a basis or foundation for subsequent analysis." See Annear Dec., Par. 21.

63. Mr. Susilo claims that "the development of the wLFRM did not consider all relevant factors." See Susilo Dec., Par. 112.

64. As I explained above, the administrative record describes how WDNR used the mathematical functions, coefficients, and data from the external models to develop the wLFRM. As I also explained above, this information is contained in the Model Documentation Report, and its six appendices, which include the report, "Development and Application of a PCB Transport Model for the Lower Fox River."

65. Mr. Susilo is also wrong to state that the wLFRM is incomplete. The absence of the pre-processors, the post-processor "Exposure.f", and the output files from the IPX computer model runs does not render the copy of the wLFRM in the administrative record incomplete for the purpose of evaluate the inputs for other models. As I explained above, the contents of the administrative record thoroughly describe the development, calibration and application of the model, and provide sufficient information for reproducing the outputs to review WDNR's application of the model.

66. Thus, Mr. Susilo is incorrect when he claims that the absence of certain model processing tools and output files from the administrative record represent "clear errors in judgment." See Susilo Dec., Par. 43.

67. Mr. Susilo also states that WDNR, in comparing various dredging alternatives to the no-action alternative, did not consider modifying the model to accommodate changes in river geometry caused by dredging. The model's failure to take this factor into account, he claims, "potentially resulted in the Governments erroneously concluding that certain areas of the Lower Fox River need remediation." See Susilo Dec., Par.61.

68. But Mr. Susilo does not demonstrate that the results produced by the model, had it taken this factor into account, would have made any difference in WDNR's and EPA's evaluation of remedial alternatives.

69. In fact, a simple assessment of Mr. Susilo's claim suggests that the model's consideration of this factor would have further supported WDNR's and EPA's remedy selections, not called them into question.

70. It is true that the removal of sediment changes the dynamic of a river, in that when sediment is removed the water has more space within which to move, which in turn slows down the river's flow velocity. It is also true that the wLFRM did not factor in this change.

71. But a slower flow velocity in the river following sediment removal would have reduced the rate of subsequent PCB transport, because a slow-moving river scours less sediment from the river bed. Thus, to the extent this factor would have made any difference, the model's failure to represent it would have resulted in an underestimation of the effect of sediment removal on subsequent PCB transport within the river system.

72. In other words, had the model taken this factor into account, and had this factor made any meaningful difference, that difference would have made the various remedial alternatives considered by WDNR and EPA compare *more favorably* to some extent, to the no action alternative supported by the defendants, not less favorably. If anything, Mr. Susilo's analysis demonstrates that WDNR's and EPA's model analyses could have shown more significant benefits of remediation compared to no action regarding this variable.

73. Finally, Mr. Susilo claims that different results from the model might have been obtained if different parameters had been used during the model runs. There are two fundamental conclusions to draw from these claims by Mr. Susilo.

74. First, Mr. Susilo's analysis appears to be based on his own re-runs of the model using alternative values to reproduce WDNR's no-action model results and also produce alternative input files for the IPX program. Specifically, he appears to have modified the values of the variables related to sediment loading into and sediment mixing within the river.

75. The fact that Mr. Susilo can apparently re-run the WDNR's no-action option and with his alternative options contradicts his own claims and the claims of Dr. Annear that they do not have complete and working copies of the model, and that they can not replicate model runs and reproduce its results.

76. The second significant conclusion to be drawn is that Mr. Susilo's claims that the model produced inaccurate results do not call into question EPA's and WDNR's selection of PCB cleanup levels at the Lower Fox River Site.

77. For example, Mr. Susilo claims that the model did not appropriately take sediment loading, and the depth of sediment mixing in the river, into consideration in calculating PCB reductions under the no action alternative.

78. Mr. Susilo appears to have re-run the wLFRM using different values for suspended solids loading from watersheds and the depth of sediment mixing in the river. Figures 2 and 3 of his Declaration present the different model results produced by his use of these alternative values comparing to the WDNR's no-action model results.

79. However, the different modeling results produced by Mr. Susilo are inconsequential in terms of EPA's selection of a PCB cleanup level. This is illustrated by my Diagram 2, below, which presents Mr. Susilo's revised model results for the no action alternative based on his modified values, and shows them in comparison to the model results produced by WDNR for the various dredging alternatives for that stretch of the river, including no action alternative.

80. As Diagram 2 shows, Mr. Susilo's modification used to run the model makes only a trivial difference when compared to the WDNR's model results obtained from the "no action"

alternative (i.e., no removal of sediment), and has almost no effect on the comparison of how various remediation scenarios considered by WDNR and EPA will reduce PCB concentration in the surface sediment, which directly affect PCB burdens in biota, such as fish.

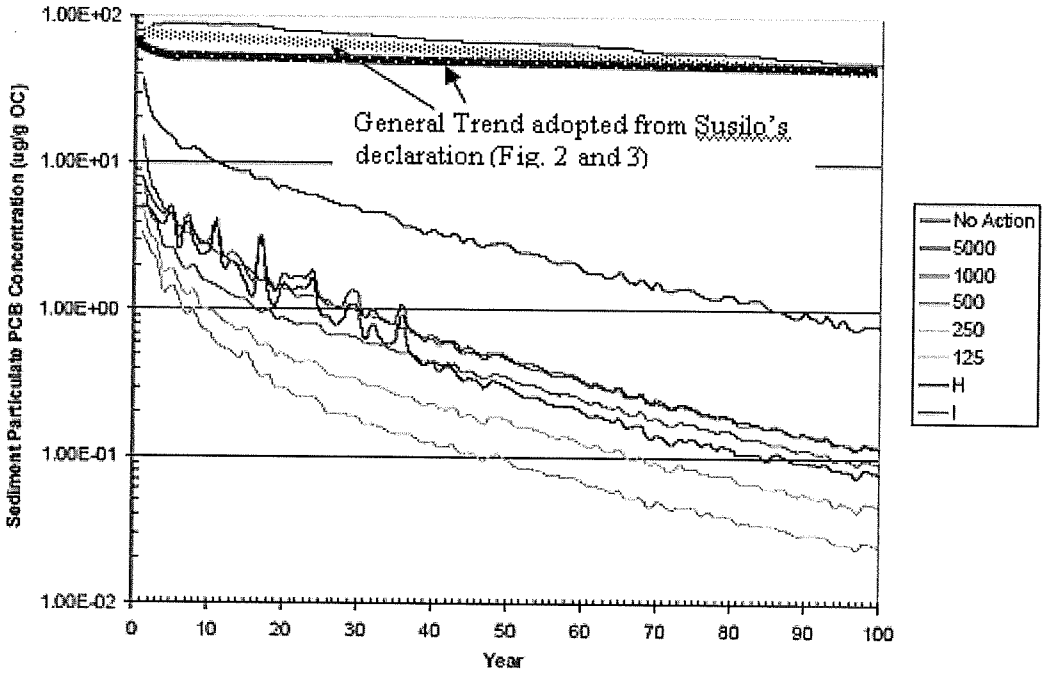

Diagram 2. Comparison of PCB concentrations in surface sediment from the model sensitivity runs presented by Mr. Susilo and in the Final Model Documentation report by

81. As Diagram 2 illustrates, Mr. Susilo's changes in the input variables may have produced different results, but the results would not have made any meaningful difference to EPA's and WDNR's remedy selection analysis. Despite the relatively faster reductions in PCB concentrations under the "no action" scenario as expressed in Mr. Susilo's alternative model run using different values (for which no model calibration was conducted), it is still clear that the remedial alternatives considered by EPA and WDNR produced dramatically improved reductions in PCB concentrations over time.

Sworn to this eighteenth day of June, 2012.

Xiaochun Zhang